

Phosphorus regulates stream injury by filamentous green algae, DO, and pH with thresholds in responses

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Abstract Nutrient concentrations, benthic algal biomass, dissolved oxygen (DO), and pH were measured in 70 or more streams during spring and summer in the Illinois River Watershed (IRW), which crosses the Oklahoma and Arkansas (USA) border, to determine whether injury to streams occurred and if that injury was related to spreading poultry waste on fields. Definitions of injury were based on Oklahoma water quality regulations and scientific literature. Phosphorus and nitrogen concentrations were each independently related to poultry house density (PHD) in watersheds and percent urban land use in watersheds. In addition, phosphorus and nitrogen concentrations were unusually high compared to regions with similar geology and hydrology. Molar N:P ratios were high and indicated that phosphorus was the most likely limiting nutrient. Phosphorus concentrations, as well as PHD and urban land use, were related to algal biomass during spring, but were less related during summer. A threshold response in cover of stream bottoms by nuisance filamentous green algae (NFGA: *Cladophora*, *Rhizoclonium*, and *Oedogonium*) during spring was observed at 27 lg TP l⁻¹ using regression tree analysis. Great increases in average NFGA cover (from 4 to 36% cover) occurred with relatively small increases in TP concentration at the 27 lg TP l⁻¹ threshold. Average concentrations of DO, variability in DO, and pH during spring were positively related to TP, chlorophyll a, and NFGA cover. Minimum DO during spring and early morning

DO during summer were negatively related to TP concentration. Spring pH and summer DO frequently violated water quality requirements for protecting biodiversity that were established by the state of Oklahoma. We conclude that poultry house operations as well as urban activities, independently and interactively, pollute IRW streams with phosphorus, which resulted in injury to aesthetic condition and the potential for

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injury of biodiversity.

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